Mesh-Tension Driven Expression-Based Wrinkles for Synthetic Faces

Appendices

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A. Illustrating Tension Parameters

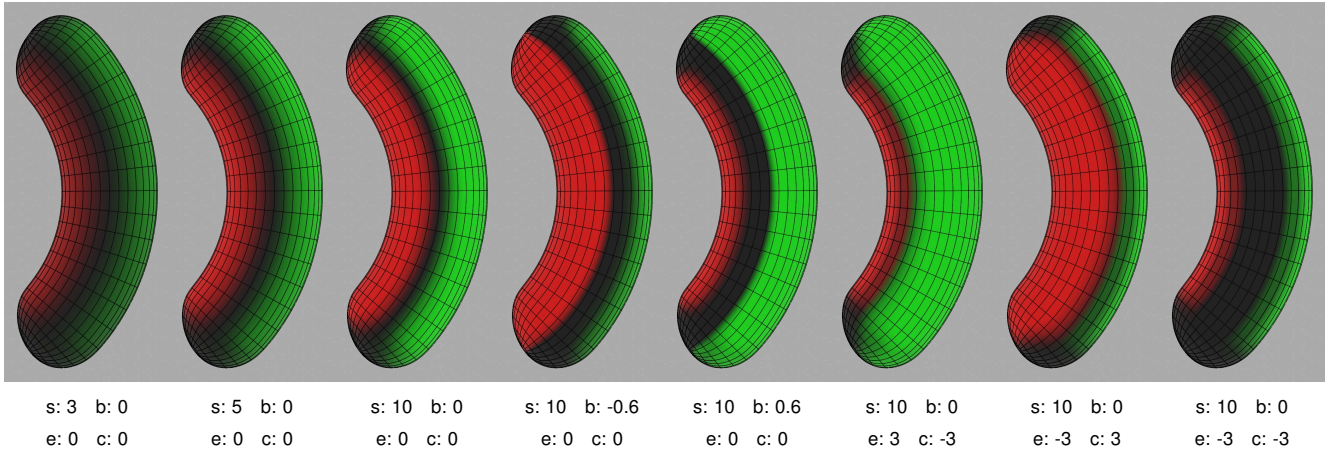| s: 3 b: 0 | s: 5 b: 0 | s: 10 b: 0 | s: 10 b: -0.6 | s: 10 b: 0.6 | s: 10 b: 0 | s: 10 b: 0 | s: 10 b: 0 |
| e: 0 c: 0 | e: 0 c: 0 | e: 0 c: 0 | e: 0 c: 0 | e: 0 c: 0 | e: 3 c: -3 | e: -3 c: 3 | e: -3 c: -3 |

Figure 13: **Tension Parameters - Cylinder.** Illustrating the effect of varying tension parameters on a simple cylinder mesh. Legend: s - strength, b - bias, e - iterations for dilating/eroding expansion, c - iterations for dilating/eroding compression.
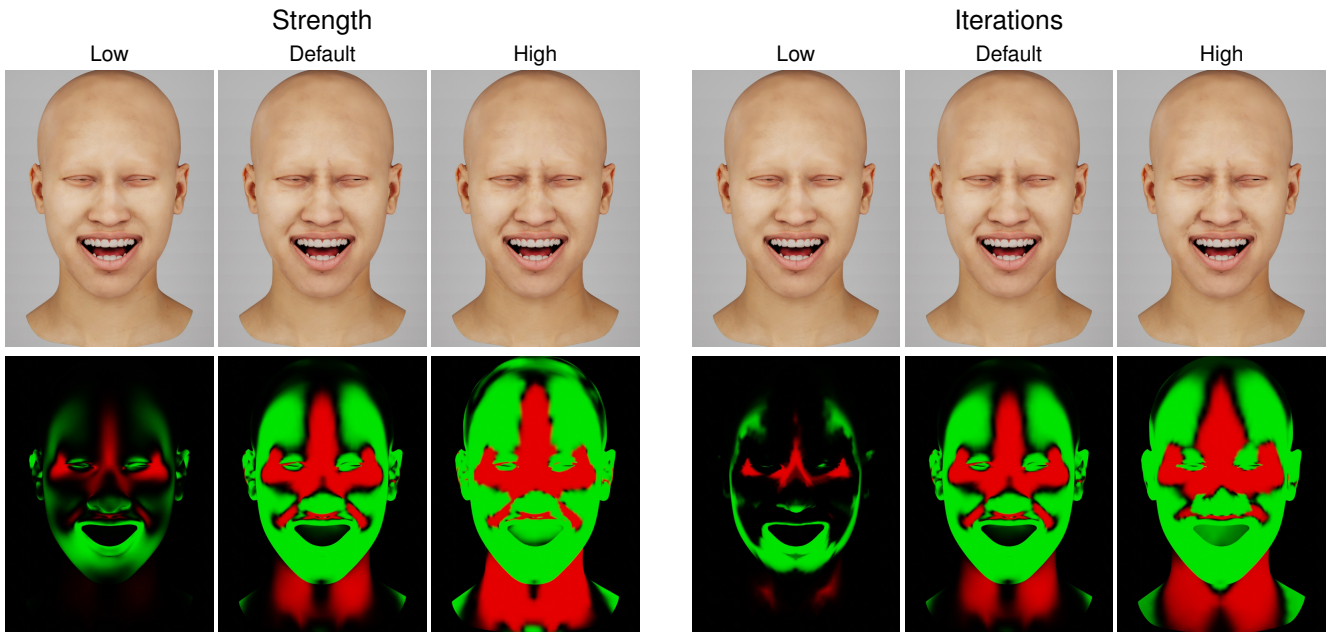

Figure 14: **Tension Parameters - Face.** Illustrating the effect of varying tension parameters on a face mesh.

B. Eye-Region Landmark Metrics

To deal with different landmark annotation conventions (e.g. 68, 98, 703 landmarks), we use a point to polyline distance. For each eyelid point in the prediction, we measure its distance to the relevant polyline, e.g. for a predicted point on upper-left eyelid we measure the distance from it to upper-left eyelid polyline (illustrated in Figure 15). This allows us to compare models with different annotation schemes and to have a better understanding of eye region error.

In cases where we do not have landmark annotations, but we know that both eyes are closed (or a single eye is closed), we can use the eye opening/aperture error instead. This is illustrated in Figure 16. The limitation of this approach is that it measure the relative openness of eye only and will have a low error even if the location of eyelid is wrong (but the aperture is correct). However, in combination with other metrics it provides a good signal to how well the models deal in detecting winks and blinks.
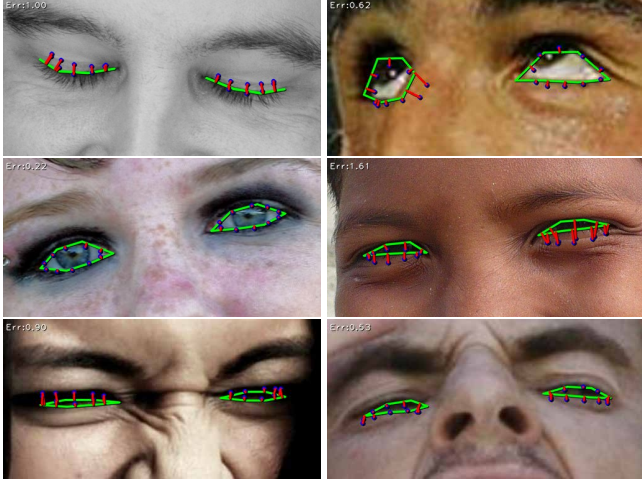

Figure 15: **Point-to-Line Distance Metric**. Green: ground truth annotation polyline. Blue: predicted eyelid landmarks. Red: residual distance. Top-left corner: associated error.
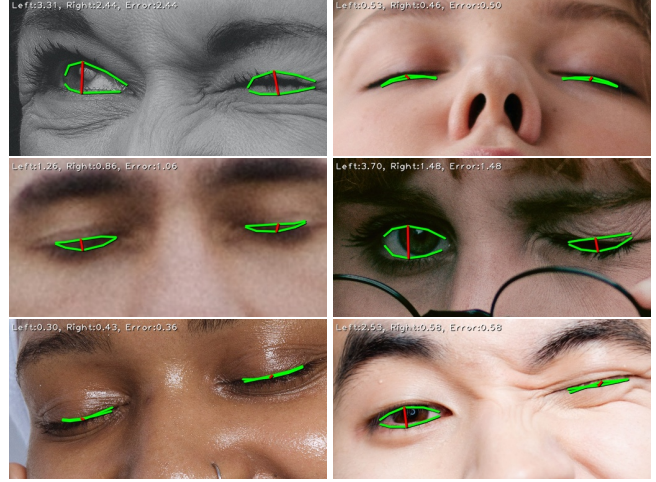
Figure 16: **Eye Opening / Aperture Error**. Green: prediction. Red: distance between the top and bottom lid that measures eye opening. Top-left corner: eye-opening of the left and right eye and the subsequent error.

C. Landmark Predictions on 300W

We present examples of predictions on 300W dataset from models trained on real and synthetic data in Figure 17.

D. Surface-Normals Predictions

In Figure 18 we show further comparisons to the recent face surface-normals prediction techniques of Abrevaya et al. [62] and Sengupta et al. [63].

Figure 19 shows failure cases from Abrevaya et al. [62] and our results on the same images. It is clear that our technique results in a significantly more robust model which can deal better with extreme lighting conditions, occlusions and darker skin tones. Note that when training our model we take the surface of glasses lenses into account, though it is also possible to ignore these and predict for the face underneath depending on how the rendering pipeline is configured. In all figures relating to surface-normals prediction we use our own face alignment to select the region of interest (ROI) to input to the normals prediction U-Net model, which causes some misalignment with the ROI used in other techniques.

E. The 300W-winks Subset

The subset of 300W images that make up 300W-winks is:
indoor_048, indoor_052, indoor_053, indoor_054, indoor_055, indoor_089, indoor_094, indoor_099, indoor_180, indoor_226, indoor_242, indoor_253, indoor_264, indoor_267, indoor_278, indoor_280, indoor_282, indoor_286, outdoor_073, outdoor_076, outdoor_077, outdoor_089, outdoor_097, outdoor_145, outdoor_165, outdoor_209, outdoor_243, outdoor_249, outdoor_251, outdoor_292.
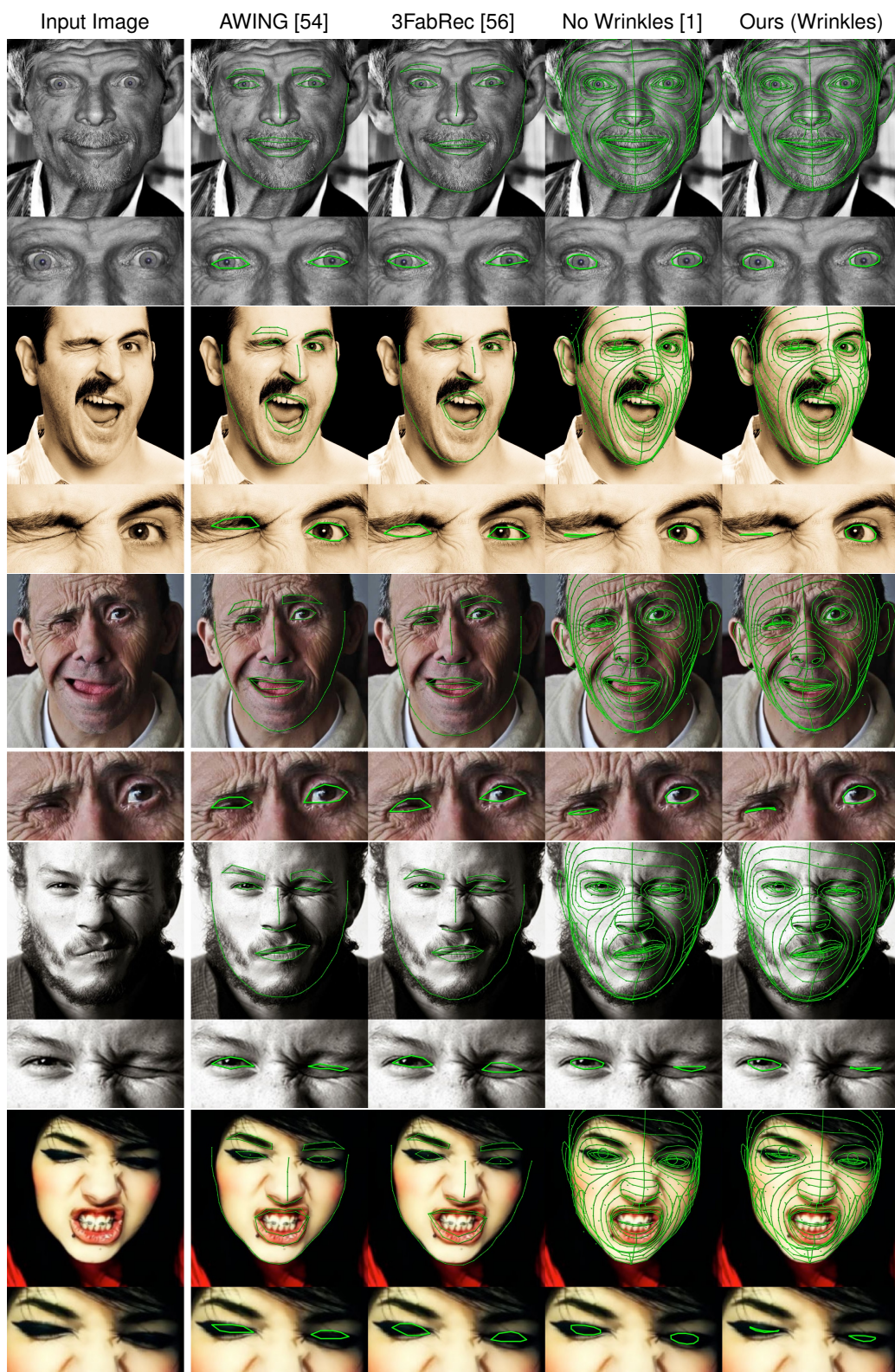
Figure 17: **Qualitative Comparison against SOTA**. Comparing prediction on 300W against SOTA models for facial landmark detection, our synthetic-only model often results in better accuracy for eye region, with improved performance for wink detection with mesh-based tension data.
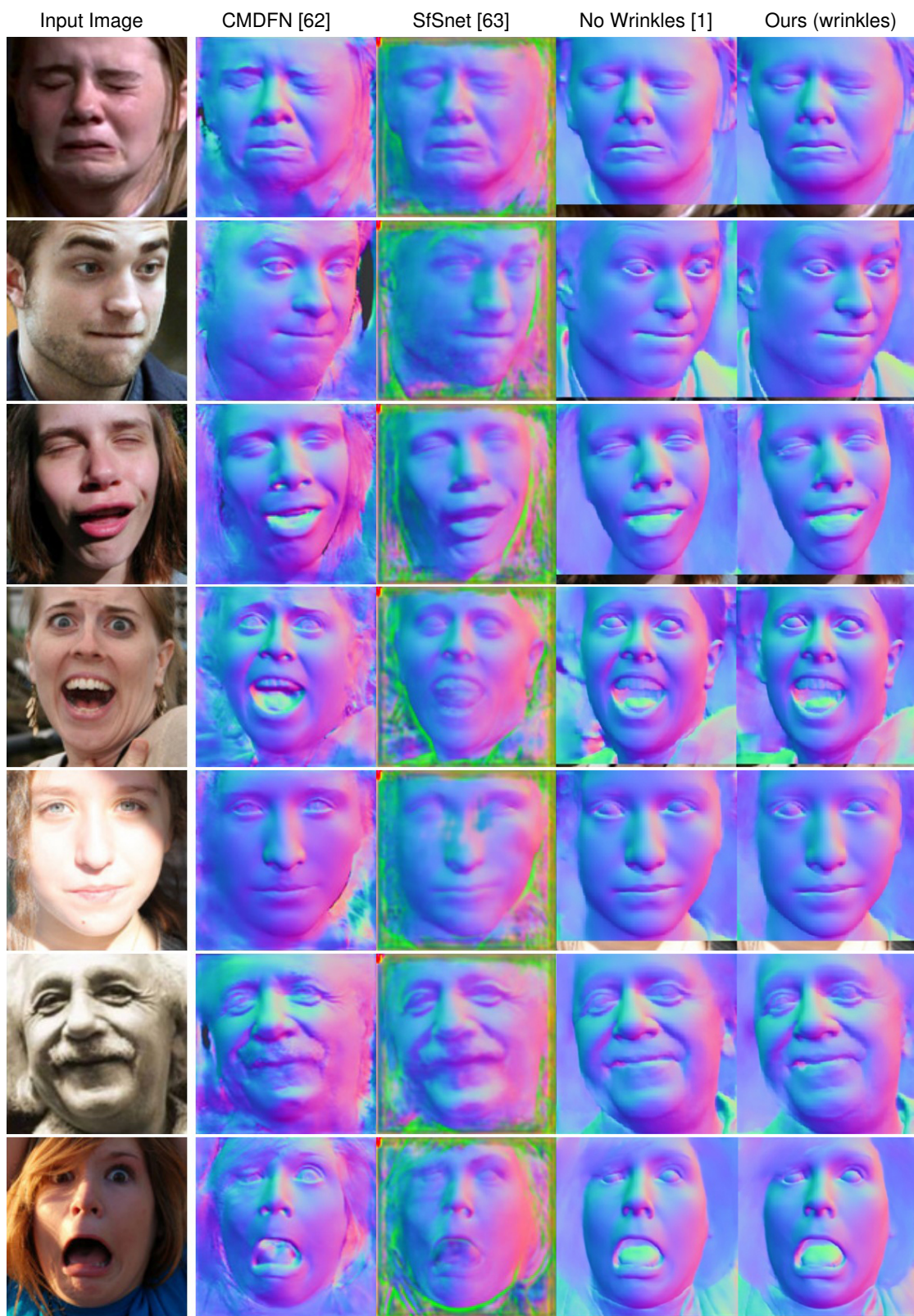
Figure 18: **Surface-Normals Comparison.** Qualitative results for surface-normals compared with two recent approaches. Note that we use our own face-alignment resulting in slight offset of the predicted ROI.
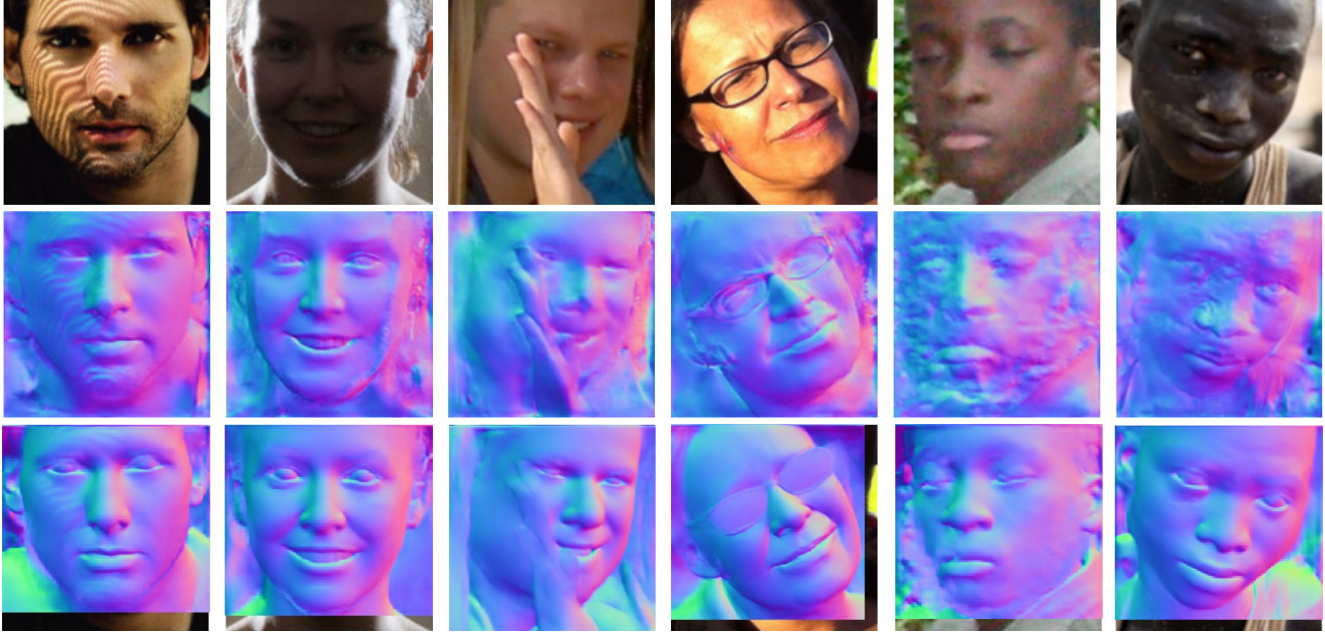
Figure 19: **Surface-Normals Robustness.** Comparison of surface-normals prediction to failure cases from Abrevaya et al. [62], showing input (top), Abrevaya et al. (middle) and Ours (bottom). Our approach is significantly more robust in cases of extreme lighting, occlusion and darker skin.

F. The Pexels Winks and Blinks Dataset

All images can be accessed by appending to `https://www.pexels.com/photo/`

F.1. Blinks subset

```
abhishek-sinari-2026945, adrienne-andersen-2552127, adrienne-andersen-2552131,
alekke-blazhin-7448048, alekke-blazhin-8450287, alekke-blazhin-8450288,
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alena-shekhovtcova-7036537, alesia-kozik-7295537, alex-green-6626087,
alexander-krivitskiy-4383786, alexander-stemplewski-2906663, alexandr-podvalny-1540408,
alexandra-patrusheva-6806789, ali-karimiboroujeni-11381826, alina-blumberg-6925493,
alyona-pastukhova-11495069, amar-preciado-10820282, amr-osman-10665375,
anastasia-ilinamakarova-10832112, anastasia-shuraeva-7539962, anastasia-trofimczyk-10311002,
anastasiia-chaikovska-11834502, anastasiia-shevchenko-10568846, andre-porto-7753232,
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yan-krukov-6617027, yan-krukov-7155545, yana-sperry-11810044, yaroslav-shuraev-6281021,
zayceva-tatiana-11210581, zayceva-tatiana-11698072

F.2. Winks subset

airam-datoon-9637814, alena-darmel-7322312, alena-darmel-8153597, alexander-krivitskiy-6471731,
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dazzle-jam-2020992, debendra-das-5429301, deepak-digwal-3577006, ekaterina-glushenko-8993965,
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